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Human Factors Material for World-Wide -Web Site

- Final Report -

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Abstract

Extensions and refinements were made to DCIEM's Human Factors Engineering (HFE) Guide, containing a variety of standards information currently accessible to users on an Internet demonstration site supplied by AIM. A key addition to the Guide was the use of cookies, which now allows the Guide to restore the state of a variety of variables when that user returns from other sections or after logging off and returning at a later time. The restored state includes items in the standards that were bookmarked by the user and the results of the user's last search. Additional material was added to the Guide and redundancy removed from two sections of its sections. For one of those, a re-design of the Java interface was required.

Although plans were to upload the Guide to the DRDC DWAN and Public www sites, technical issues prevented that task from being completed in this work phase. Two unresolved issues relate to policies surrounding the use of cookies and to the use of Java on the DRDC sites. Discussion will continue with the Scientific Authority and the Manager of the DRDC site in an attempt to resolve those issues in a way that will allow the HFE Guide to be included on one or more sites.

Finally, some future enhancements to the Guide were examined and requirements for eleven new tasks discussed. A number of uncertainties surround those tasks but, in principle, all can be achieved. Costs and timing estimates were provided.

Résumé

Plusieurs extensions et perfectionnements ont été apportés au Guide HFE (ergonomie) de l'IMED, qui renferme une grande diversité d'informations sur les normes, accessibles aux utilisateurs depuis un site Internet de démonstration fourni par l'AIM. Un perfectionnement de taille a été l'exploitation de témoins (cookies), ce qui permet dorénavant de rétablir l'état de diverses variables quand l'utilisateur revient à une section précédente ou se reconnecte lors d'une nouvelle session. L'état rétabli comprend des éléments des normes marqués d'un signet par l'utilisateur et les résultats de la dernière recherche effectuée par celui-ci. Du matériel supplémentaire vient compléter le Guide et on a éliminé la redondance dans deux des sections. Dans l'une d'elles, une reconception de l'interface Java a été nécessaire. Bien que des plans aient été élaborés pour faire le téléchargement montant du Guide vers le DWAN du DRDC et des sites Web publics, des problèmes techniques empêchent de mener à bien cette tâche dans la présente phase du travail. Deux questions non réglées touchent les politiques régissant l'emploi de témoins et l'usage de Java sur les sites de la DRDC. Des discussions se poursuivent avec l'Autorité scientifique et la direction du site DRDC sur les diverses solutions possibles qui permettraient d'inclure le Guide HFE dans un ou plusieurs sites. Finalement, certains perfectionnements envisagés au Guide ont été examinés et les besoins connexes à 11 nouvelles tâches ont été discutés. Un certain nombre d'imprécisions affecte ces tâches, mais, en principe, leur réalisation ne ferait aucune doute. Des estimations de coûts et de durées sont fournies.

Executive Summary

From 1993 to 1995 DCIEM developed a series of hypertext software modules that provided access to available human engineering standards. HFE-Guides I, II, and III were developed to run on Macintosh computers. HFE-Guide I was developed for army applications, HFE-Guide II was aimed at all three elements and HFE-Guide III was based on design standards for the aircrew-machine interface. In 1999 DCIEM accepted an unsolicited proposal from Artificial Intelligence Management and Development (AIM) Corporation to transfer the HFE-Guide material from Macintosh-based software to run on the world-wide-web (www) using Java software protocols to widen the availability of the material. The work was completed in March 2000, and since that time the contractor has hosted the software on their own world-wide-web site at no cost to DND. The objectives of this contract were to:

1. deal with legacy problems inherited from the Hypertext HFE-Guide,
2. incorporate material excluded from the 1999 conversion to Java,
3. incorporate changes in some of the US standards used in HFE-Guide,
4. deliver it for installation on the DRDC www sites
5. study the feasibility and cost of future enhancements to the HFE-Guide.

The legacy problems from the earlier HyperCard versions of HFE Guide fell into three distinct categories: 1) Content issues; 2) Interface issues; and 3) DRDC site issues. Each of these areas was addressed by modificationst to the site material.

The most important of the content issues was the verification that all cross-references from the old HC version had been incorporated into the new Java version. A second content issue item was to investigate material contained in the "Utilities Folder" of the older HFE Guide II, to determine the nature of that material, where it belonged in the new Java version of the Guide, and to incorporate it as appropriate. The third legacy content issue was to restrict the search mechanism to the appropriate section(s) of the Guide.

Several extensions and refinements were made to the HFE Guide. A key addition was the use of cookies, which now allows the Guide to restore the state of a variety of variables when that user returns from other sections or after logging off and returning at a later time. The restored state includes items in the standards that were bookmarked by the user and the results of the user's last search.

Additional material was added to the Guide and redundancy removed from two sections of its sections. For one of those, a re-design of the Java interface was required. A key piece of material excluded from the 1999 Java implementation was the Data Item Description (DID) Tutorial. That information was extracted from the HyperCard version and now appears in the Java-based HFE Guide. All glossary items were collected into a general glossary and made accessible from the Guide's main window via a 'radio button.'

Although plans were to upload the Guide to the DRDC DWAN and Public www sites, technical issues prevented that task from being completed in this work phase. Two unresolved issues relate to policies surrounding the use of cookies and to the use of Java on the DRDC sites. Discussion will continue with the Scientific Authority and the Manager of the DRDC site in an attempt to resolve those issues in a way that will allow the HFE Guide to be included on one or more sites.

Finally, some future enhancements to the Guide were examined and requirements for eleven new tasks discussed. Thes enhancements include adding other standards (NATO ANEPS 20 to 28) replacing MIL-STD-46855 material with MIL-HDBK-46855A, making references selectable and identifying the source of search results, and creating 'intelligent' links between task analysis and design material in the Guide. A number of uncertainties surround those tasks but, in principle, all can be achieved. Costs and timing estimates were provided.

Sommaire pour la direction

De 1993 à 1995, IMED a produit des modules logiciels hypertexte qui donnent accès aux normes d'ergonomie disponibles. Les Guides HFE I, II et III ont été développés pour fonctionner sur des ordinateurs Macintosh. Le Guide HFE I est destiné aux applications de l'armée, le Guide HFE II s'adresse aux trois éléments et le Guide HFE III est fondé sur les normes de conception de l'interface Équipage-machine. En 1999, IMED a accepté la proposition non sollicitée émanant de la société AIM (Artificial Intelligence Management and Development) pour effectuer le transfert du matériel des guides HFE du logiciel Macintosh à une solution Web exploitant les protocoles Java pour élargir l'accessibilité de cette documentation. Ce travail s'est terminé en mars 2000, et depuis ce temps l'entrepreneur héberge le logiciel sur son site Web sans frais pour le MDN. Les objectifs de ce contrat étaient :

1. prendre en considération les problèmes déjà soulevés dans le Guide HFE hypertexte,
2. incorporer le matériel exclus de la conversion de 1999 dans Java,
3. intégrer les changements de certaines normes américaines mises en pratique dans le Guide HFE,
4. déployer le produit et l'installer sur les sites de DRDC,
5. étudier la faisabilité et les coûts des améliorations à venir au Guide-HFE.

Les problèmes déjà soulevés avec les versions HyperCard précédentes du Guide HFE se classent en 3 catégories : 1) Problèmes en matière de contenu; 2) Problèmes en matières d'interface et 3) Problèmes avec les sites DRDC. Chacune de ces catégories a entraîné des modifications dans le matériel du site.

Le plus important des problèmes en matière de contenu a touché la vérification des références croisées découlant de l'intégration de l'ancienne version HC dans la nouvelle version Java. Un second problème en matière de contenu a conduit à examiner le matériel contenu dans le « Utilities Folder » de l'ancien Guide HFE II, pour déterminer la nature de ce matériel, l'emplacement où il devrait figurer dans la version Java et son intégration en conséquence. Le troisième problème soulevé en matière de contenu concernait la restriction du moteur de recherche aux sections appropriées du Guide.

Plusieurs extensions et perfectionnements ont été apportés au Guide HFE. Un perfectionnement de taille a été l'exploitation de témoins (cookies), ce qui permet désormais de rétablir l'état de diverses variables quand l'utilisateur revient à une section précédente ou se reconnecte lors d'une nouvelle session. L'état rétabli comprend des éléments des normes marqués d'un signet par l'utilisateur et les résultats de la dernière recherche effectuée par l'utilisateur.

Du matériel supplémentaire vient compléter le Guide et on a éliminé la redondance dans deux des sections. Dans l'une d'elles, une reconception de l'interface Java a été nécessaire. Une pièce clé du matériel exclus de l'implémentation Java de 1999 était le tutoriel DID (Description des éléments de données). Cette information a été extraite de la version HyperCard et figure à présent dans le Guide HFE basé sur Java. Toutes les entrées du glossaire ont été assemblées dans un glossaire général et rendues accessibles dans la fenêtre principale du Guide par le biais d'un « bouton radio ».

Bien que des plans aient été élaborés pour faire le téléchargement montant du Guide vers le DWAN du DRDC et des sites Web publics, des problèmes techniques empêchent de mener à bien cette tâche dans la présente phase du travail. Deux questions non réglées touchent les politiques régissant l'emploi de témoins et l'usage de Java sur les sites de la DRDC. Des

discussions se poursuivent avec l'Autorité scientifique et la direction du site DRDC sur les diverses solutions possibles qui permettraient d'inclure le Guide HFE dans un ou plusieurs sites.

Finalement, certains perfectionnements envisagés au Guide ont été examinés et les besoins connexes à 11 nouvelles tâches ont été discutés. Ces perfectionnements comprennent les actions : ajouter d'autres normes (NATO ANEPS 20 à 28), remplacer MIL-STD-46855 par MIL-HDBK-46855A, rendre les références sélectionnables, identifier la source des résultats de recherche et créer des liens « intelligents » entre analyse de tâche et matériel de conception dans le Guide. Un certain nombre d'imprécisions affecte ces tâches, mais, en principe, leur réalisation ne ferait aucune doute. Des estimations de coûts et de durées sont fournies.

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Abstract

Extensions and refinements were made to DCIEM's Human Factors Engineering (HFE) Guide, containing a variety of standards information currently accessible to users on an Internet demonstration site supplied by AIM. A key addition to the Guide was the use of cookies, which now allows the Guide to restore the state of a variety of variables when that user returns from other sections or after logging off and returning at a later time. The restored state includes items in the standards that were bookmarked by the user and the results of the user's last search. Additional material was added to the Guide and redundancy removed from two sections of its sections. For one of those, a re-design of the Java interface was required.

Although plans were to upload the Guide to the DRDC DWAN and Public www sites, technical issues prevented that task from being completed in this work phase. Two unresolved issues relate to policies surrounding the use of cookies and to the use of Java on the DRDC sites. Discussion will continue with the Scientific Authority and the Manager of the DRDC site in an attempt to resolve those issues in a way that will allow the HFE Guide to be included on one or more sites.

Finally, some future enhancements to the Guide were examined and requirements for eleven new tasks discussed. A number of uncertainties surround those tasks but, in principle, all can be achieved. Costs and timing estimates were provided.

Background

From 1993 to 1995 DCIEM developed a series of hypertext software modules that provided access to available human engineering standards. HFE-Guides I, II, and III were developed to run on Macintosh computers. HFE-Guide I was developed for army applications, HFE-Guide II was aimed at all three elements and HFE-Guide III was based on design standards for the aircrew-machine interface. In 1999 DCIEM accepted an unsolicited proposal from Artificial Intelligence Management and Development (AIM) Corporation to transfer the HFE-Guide material from Macintosh-based software to run on the world-wide-web (www) using Java software protocols to widen the availability of the material. The work was completed in March 2000, and since that time the contractor has hosted the software on their own world-wide-web site at no cost to DND.

The www version of HFE-Guide has been accessed and reviewed by human factors specialists in DND. Despite problems inherited from the hypertext version, and limitations of the current software, response to the material has been positive. It has been decided that the www version of the HFE-Guide should be incorporated into the web site for Human Systems Integration (HSI) run by Defence Research and Development Canada (DRDC), on both their DND Intranet and on their public Internet www sites. Additional development is required to meet that goal.

Study Objectives and Work Items

STUDY OBJECTIVES

The objectives of this contract are to:

1. deal with legacy problems inherited from HFE-Guide,
2. incorporate material excluded from the 1999 conversion to Java,
3. incorporate changes in some of the US standards used in HFE-Guide,
4. deliver it for installation on the DRDC www sites
5. study the feasibility and cost of future enhancements to the HFE-Guide.

WORK ITEMS

The following work items were undertaken:

1. Deal with Legacy Problems Inherited from HFE-Guide

a. Cache accessed text so when it is re-displayed it will appear much more quickly
b. Provide user feedback that the server is being accessed.
c. Verify that all cross-references from the old HC version are included in the new Java version and clean-up empty cross references (broken links) left over from HyperCard.
d. Identify the purpose of certain items in the Utilities Folder of the HFE II and decide if and how they should be implemented.
e. Dim the 'forward' and 'backward' buttons when they are not available.
f. Modify the help function to run properly in the Java environment.
g. Simplify and improve the interface appearance to be compatible with usage on the DRDC www site.
h. Provide support for re-compiling the cgi script from the demonstration site.
i. Implement pop-up labels to allow users to see all the text of items, without scrolling, when the user pauses the cursor briefly over the top of the text.
j. Add the note, "No items found" when a search does not return a result.
k. Restrict searches to appropriate portions of the Guide and reflect this in the "Search Options" window.
l. Investigate and clean up symbols, which could not be represented in the old HC version, e.g., degrees, plus-and-minus symbol

During the course of this contract, redundancy in the Table of Contents for the Task Analysis and Test Methods sections of the HFE Guide was identified as a problem Changes to the Test Methods section proved a relatively easy extension to the interface work but the interface for the Task Analysis Information Window required a complete re-design.

2. Incorporate Material Excluded from the 1999 Conversion to Java

a. The DID Tutorial from the HFE-Guide III.
b. Provide users with an explicit Glossary as in HFE Guide II co-ordinated with current "Definitions" from the "MIL-STD-1472 Except Section 5.
c. Provide support for the use of 'cookies,' where possible, to maintain bookmark settings for users.
d. Clean up the software to operate in Netscape.

3. Incorporate Changes in Some of the US Standards Used in HFE-Guide

a. Add general warning terms, to be agreed with the Scientific authority, that:
   i) MIL-H-46855 has been replaced by MIL-HDBK-46855;
   ii) several of the AIR STDS and STANAGS have been replaced;
   iii) DRDC does do not agree with the approach to anthropometry and readers should contact DCIEM specialists;
   iv) DRDC does not support the tests for noise levels and readers should contact DCIEM specialists.

4. Deliver the Resulting Version of HFE-Guide for Installation on the DRDC DWAN and Public WWW Sites

a. demonstrate the successful completion of all work items in 1 and 2 above to the Scientific Authority and the manager of the DRDC www.site.
b. liase with the manager of the DRDC site to establish requirements for transfer.
c. transfer the HFE-Guide material to the DRDC site manager.
d. advise on installation and trouble-shooting if necessary.

5. Study the Feasibility and Cost of Future Enhancements to the HFE-Guide

a. replacing the current MIL-HDBK-46855 material with MIL-HDBK-46855A.
b. exploring the implications of changing material in HFE-Guide, e.g., replacing MIL-H-46855; does the existing architecture support such changes, or should we adopt an architecture based on a search engine without the links inherited from the HyperCard version?
c. implementing the seven NATO Allied Naval Engineering Publications (ANEPS20 - 28) within HFE-ICADD or separately.
d. making references selectable, as in the original HFE-Guide.
e. providing users the opportunity to give feedback about the site and suggest possible useful additions and modifications.
f. refreshing the portion of the Java Window beyond Java control in the Java Applet Warning area.
g. identifying the source of each search result for the user.
h. maintaining a history of hypertext movement when selecting cross-references (see also Search Results section, below).
i. creating 'intelligent links' between the task analysis material and the design guide material.

j. re-scanning images at higher resolutions (1200 dpi) in order to produce clearer images for printing.
k. implementing a print function for items in the windows of the Java application.

An item emerged during the course of this contract that was of interest to the Scientific Authority, which was addressed in this section. That was a desire to replace the current MIL-STD-1472D material with that of MIL-STD-1472F.

6. Prepare a Final Report on the Work Detailing the Results of Feasibility and Scoping Studies Carried out in Work Item 5

Extension and Refinement to DCIEM's Human Factors Engineering (HFE) Guide

All of the study objectives were completed with the exception of uploading the HFE Guide to DRDC www sites. Technical issues surrounding DRDC's policy regarding Java applications prevented the completion of the latter task. Discussions are continuing in an attempt to accommodate the HFE Guide work to DRDC requirements.

During the course of this contract, it became apparent that a major re-design and implementation of one section of the HFE Guide was needed to remove redundancy in its Table of Contents. That work was done at no extra cost to the client. A request to examine the possibility of replacing MIL-STD-1472D with MIL-STD-1472F in the HFE Guide was also accommodated at no cost.

I. Legacy Problems Inherited from HFE-Guide

The legacy problems from the earlier HyperCard versions of HFE Guide can be organised into three distinct types: 1) Content issues; 2) Interface issues; and 3) DRDC site issues.

Content Issues

The most important of the content issues was the verification that all cross-references from the old HC version had been incorporated into the new Java version, including all empty references (broken links). Although all of the basic cross-references now appear to be working, problems with many of the cross-references and especially with navigation issues in the HyperCard versions have made this task a challenging one.

Navigation in the HyperCard versions very often did not take the user to the location where he or she might expect to be taken, especially when navigating back from some reference, cross-reference or clickable (i.e. selectable by clicking a mouse button) item. That was compounded by a lack of continuity in content among earlier and later versions, e. g., by the fact that some items included in the stacks of HyperCard HFE Guide II were not included in those of HFE Guide III.

Further, clickable references in the content of some of the HyperCard sections are not supported in the Java version. The feasibility of providing that kind of support is addressed in a later section of this report.

It is likely that there remain a few references and cross-references that need attention and those will be addressed as they are discovered. Such remaining items, however, will have been minimised by the current efforts.

A second content issue item was to investigate material contained in the "Utilities Folder" of the older HFE Guide II, to determine the nature of that material, where it belonged in the new Java version of the Guide, and to incorporate it as appropriate. That investigation pointed out other limitations of the HyperCard implementations.

First, much of the material from HFE Guide II was not integrated into HFE Guide III, e.g., the Test Methods and Task Analysis Information stack content. Further, having identified the nature of the Utilities Folder material (form templates) and the location where those templates belonged (as cross-references in the Test Methods section of the Guide), it was discovered that links to that material were not complete. The material now appears in the Java-based Guide and the forms appear in the cross-references section when the associated content is displayed.

The third legacy content issue addressed was to restrict the search mechanism to the appropriate section(s) of the Guide. Checks are now in place to determine which area of the Guide the user has selected for search.

Occasionally, a search for information produces no results. When that happens, the Guide now informs the user of that fact. This is true for searches of the various sections of the Guide and for items searched for in the currently displayed content panel.

The final content legacy item addressed was a clean up of problems associated with the representation of special symbols, i. e., the pi symbol (π), the plus-and-minus symbol ($\pm$), and degrees symbol ($^\circ$). Those are now corrected. As with the cross-references content issue above, the occasional problem may appear but the ones identified here have been addressed.

Interface Issues

The first of these issues was to provide users with feedback when the system is searching the server for requested information. In previous versions of HFE Guide, if there were a delay in accessing the server and retrieving and presenting material, the user received no feedback of the background activity, thus tempting the user to take other actions to produce a response from the system. That situation often led to initiating other searches, causing further delays, leading to other searches, and so on. The system now provides standard web-based feedback in the status area at the bottom of the display window.

Another problem for users was seeing the full titles in the Table of Contents (TOC) panel of the Guide. Although a scroll bar was provided for users to scroll horizontally so as to read the remaining part of an item, such an action is disruptive and requires that the user scroll back so that the beginning of other items are visible once again.

A popular solution to this problem is to have a small window displayed with the complete title when the user places the cursor over the top of an item and pauses for a second or two. That solution has now been implemented for the HFE Guide and users are able to see the entire title without having to scroll across the TOC.

A third interface issue involved correcting a problem with accessing help about the Guide. The user may now select a radio button that provides a Table of Contents of general information about the Guide. Selecting items in that section now brings up the appropriate help content.

Forward and Back buttons appear both in the main Java window and the graphics windows used to display figures and tables. On occasion, there may be no logical location to which the user may navigate, either forward or backward, and those buttons are now dimmed in those situations.

Finally, although graphics were cached in the last implementation to make re-displaying them more efficient, text was not. An upgrade to the Guide now permits the caching of text so that when a user returns to the same text later in a session, it will appear much more quickly.

In examining various interface issues, it was determined that there was considerable redundancy in material in the Table of Contents for the Test Methods and the Task Analysis sections of the Guide. The problem was that a hierarchy of information existed in these sections with parts of the hierarchy repeated throughout. Although the same problem existed for both sections, the hierarchy in the Test Methods was shallow whereas the one for the Task Analysis Information was deeper and more diverse.

The solution for the Test Methods section allowed for the preservation of the principal interface contents of the existing Java Window. The solution was adding tabs along the top of the content panel, all of which are the same for the different items in that section of the Guide. The consequent implementation was relatively straightforward.

In contrast, the Task Analysis Information section required a substantial re-design of the Java Window. Figure 1 shows a sketch of that window. Several additional panels have been added to accommodate the more extensive hierarchy of that section and variations that exist at the different levels.

A description of the contents of the section and instructions on how to proceed are presented at the top of the window. Users make selections as they move down in the hierarchy of information. The final displays are tasks presented by their sub-function and the conditions of use.

DRDC Site Issues

Although changes were made to the HFE Guide interface to make it more intuitive and easier to use, no explicit attempts were made to co-ordinate interface development efforts with DRDC personnel. In large measure, this was due to revisions and refinements currently underway on the DRDC site. Thus, explicit efforts to co-ordinate the two interfaces will be left to future work.

One change was made to the final version of the HFE Guide: the R&D background used on all pages of the guide was removed. Depending on the default font size, specified by a user for his or her individual Browser, some portions of that background had been found to overlap with text on the Guide's home page. Of course, if that background happens to be chosen as the background to be used, then some alterations are necessary. One possible suggestion is to lighten all background text to a level that will not interfere with the legibility of the main content on the page.

Another item included among the work items in this section was to provide support for re-compiling the cgi script from the demonstration site. This is more applicable, however, to the section dealing with the transfer of work on the Guide to DRDC personnel and will be discussed in that context.

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Description: The HFE Task Analysis Info Section provides lists of sample tasks and conditions of use Separate lists are provided for classes and sub-classes of system or equipment (e.g., aircraft sensors) and for the functions and tasks associated with their operation and maintenance This section can be used to compile a preliminary list of tasks and conditions of use associated with a system or equipment for specification, design, test and evaluation.

Instructions: Click a Class, then a Subclass and then a Function. Short descriptions appear under the first panel on the left depending on the item selected. The bottom panel on the left displays tasks organized by sub-function and conditions of use for the Class-Subclass-Function combination chosen in the top panel Selecting a task or a condition of use category will display information in the associated panel on the left of the screen.

CLass	SubCLass	Function
[Six Items]	[one to three items]	[one to five items]

[Tasks By Sub-Function]

[Contains description of Class, Subclass or Funtion selected]

[Conditions of Use]

Tasks By Sub-Function	Conditions of Use

Figure 1. Re-Designed Task Analysis Information Window

II. Incorporate Material Excluded From the 1999 Conversion to Java

A key piece of material excluded from the 1999 Java implementation was the Data Item Description (DID) Tutorial. That information was extracted from the HyperCard version and now appears in the Java-based HFE Guide.

Although there are substantial advantages to having the HFE Guide accessible on the World Wide Web, not the least of which is that it provides quick and easy access to standards information for many potential users, there are also some notable problems. Whereas a standalone version of the Guide, such as the earlier HyperCard versions, allows users to employ the Guide in a personal way, maintaining locations in the Guide and bookmarking items for future use, the Java implementation did not permit users to maintain locations in the various Table of Contents or to retain bookmarked items beyond their current session. In fact, switching between the General Standards and the Air Standards was enough to cause the Guide to reset all those items.

The development of Internet "cookies" has permitted that kind of personal information to be retained, across different sections of the Guide and across Internet sessions for a given user. Cookies are pieces of code that allow Internet site providers to associate a unique identifier with individuals accessing their site. As long as the user permits the use of cookies, the system can distinguish that user from all others using the site.

What such unique identification permits is the assignment of the "state of the site" to a user's identifier, whenever that user leaves the site or moves to different areas within the site. When the user moves from one set of standards to another, or leaves the site altogether and returns at a later time, that identifier allows the Guide to restore the previous state of the site for that user.

Work on this contract implemented cookies in a way that now permits the Guide to identify the state of: 1) table of contents for each section of the Guide; 2) bookmarks specified by a user; and, 3) results of the last search performed by a user. Retaining these three states adds considerably to the user's sense of continuity when using the Guide. Bookmarks of items a user has found particularly helpful may now be retained across sessions. The user does not have to remember were he was, say, in the 1472 standard, since the state of that Table of Contents is restored when he logs back into the site.

Although these additions should make HFE Guide more attractive to users, there are many more possible uses for cookies, including implementation of items beneficial both to users and to HFE Guide designers. An example helpful to users would be offering suggestions as to the areas of the Guide they might find useful, given some statement by users of their interests or, more subtly, given background tracking of previously visited areas of the Guide. An example useful to designers would be collecting data on areas of the Guide most often visited, or most often visited by particular users with particular interests.

Although glossary information was provided in the last version of the HyperCard implementation, that is, HFE Guide III, such a glossary was not accessible at the top level of the Guide, as it was for HFE Guide II. Even there, other glossary entries appeared in different parts of the Guide and were not included in its "top-level" glossary.

During this work phase, all glossary items were collected into a general glossary and made accessible from the Guide's main window. Specifically, a radio button was added to allow users to go directly to the glossary.

A final item in this section dealt with problems related to the Netscape Browser. A combination of upgrades by Netscape to support a more current version of Java and some refinements to our earlier work, which had required patches to older versions of that Browser, now allows for a more consistent approach to implementing the Java-based version of the Guide.

III. Incorporate Changes in Some of the US Standards Used in HFE-Guide

A number of notes and warnings were added to the pages of the Guide. These serve to qualify the content of various sections, indicating that some standards have been replaced and pointing out areas where DRDC disagrees with an approach taken or tests used.

IV. Deliver the Resulting Version of HFE-Guide for Installation on the DRDC DWAN and Public WWW Sites

A demonstration of the new version of the HFE Guide, including work items in Sections 1 & 2, above, was provided to Mr. David Beevis, the Scientific Authority, DST HP-3, and Ms. Dawn Lockwood, the Manager of the DRDC DWAN and Public www sites. Other staff at DCIEM also accessed the new version of the Guide.

Requirements for the transfer of the HFE Guide to those sites were identified by liasing with the DRDC Manager. Unfortunately, two concerns have prevented the completion of this task. Those relate to the installation of Java applications, and any application using cookies, on those sites.

In order for Java applets or cookies to be included on any of the target sites, a review and approval are necessary. At the conclusion of this contract, there are on-going discussions to determine whether uploading the HFE Guide will be possible. In lieu of completing that task, the HFE Guide site, a version of the Guide was provided to the Scientific Authority on CD-ROM. Of course, the Guide, including all of the current extensions and refinements performed in this contract, continues to be supported on the demonstration site. http://www.interlog com/~mallin/HFE_IntroPage.html

AIM is prepared to provide whatever information is necessary that might help make it possible to transfer the work on the HFE Guide to DRDC. Responses were provided to concerns expressed by the DRDC Manger and AIM continues to work with the Scientific Authority and the DRDC Manager in the spirit of the transfer task.

Finally, AIM is prepared to help troubleshoot any problems that may arise during the transfer of the Guide. One such problem may relate to cgi-scripts, which may need to be re-compiled when moved from one server to another.

V. Study the Feasibility and Cost of Future Enhancements to the HFE-Guide

Feasibility of future extensions and refinements to the HFE Guide were considered and appear in the sections below. Issues related to the costs of those extensions and refinements are summarised in Section VI.

Replace Current MIL-HDBK-46855 Material with MIL-HDBK-46855A

Two key questions surround the replacement of the existing HFE Guide material for this standard with that of the more recent (1996) handbook material. First, there is a fundamental question of whether it would be just as useful to provide users with an online copy of the handbook as it would to give them the kind of access they now have and, second, if that is not the case, then what would be involved in replacing the existing material.

There are several reasons why a simple copy of the 46855 Handbook in, say, PDF format would not be adequate for users. The principal reason is the flexibility that comes from decomposing any document into its constituent parts. If sections of a standard are available separately then flexibility exists in presenting those sections in ways that can serve a variety of purposes.

All of the potential uses of the many sections of a standard, such as 46855, cannot be anticipated but a few basic ones are already in use, namely, presenting material to users in a focused way, independent of other surrounding content, allowing users to bookmark "important" sections and providing search results that span one or more standards.

The use of the PDF format has permitted the sharing of a wide range of documents over the Internet among users of widely differing hardware platforms. Separate Adobe Acrobat Readers, which work on most, if not all, hardware platforms, are available for free from the Adobe Web site; Adobe being the Company that authored the Acrobat Reader.

Many documents that were never available before or were only available to a small number of users are now easily accessible to millions. Those documents are only available, however, in their entirety, that is, as single complete documents. Of course, they still are more useful than their hardcopy counterparts since they permit a table of contents and an index that can include clickable items. Those features allow users to navigate quickly to selected parts of a document. Also, the availability of a search facility makes finding items considerably easier than in a corresponding hardcopy version.

Although a table of contents and an index are available in the currently implemented PDF versions of the MIL-HDBK-46855A that were examined, none were clickable, so that a user must navigate manually to any section of interest.

Also, no bookmarks exist for the document that might serve as a table of contents, which often is the way the "Bookmarks" section of PDF documents is used. Similar to tables of contents in the current HFE Guide, "bookmarks" in a PDF document appear in a separate panel on the left side of the document, which may be displayed or hidden at the discretion of the user. The lack of bookmarks in the Handbook is somewhat odd as Adobe Acrobat normally generates clickable bookmarks from a table of contents when transforming documents into PDF form, that is, when transforming documents originally created using word processors such as Microsoft Word, or any desktop publishing software. Likely, the table of contents was not formally specified as such prior to converting the MIL-HDBK-46855A to PDF form.

Although this can still be done, it would be time consuming to generate and the typical user is not likely to take the time to do that. Such a task would be even less likely for the index. An advantage in the PDF version of the 46855A Handbook is that an index already exists; the disadvantage is that none of the items are clickable.

Again, the principal reason for converting the 46855A Handbook material into the format used for the HFE Guide is the flexibility it provides. That flexibility is illustrated in the Guide's tables of contents, in the ability it provides users to bookmark items and it the ability for searching any and all standards for items of interest. Unlike the complete documents in PDF form, the material can be presented in focused ways that make it easy for users to address issues and answer questions that concern them. Further, when they return to the HFE Guide site, after some lapse of time, the bookmarks, latest search results and tables of contents are as they were when they left them.

Another important advantage to the way in which standards information is organised in the HFE Guide is its ability to present cross-referenced material to users. That kind of information normally is not found in PDF and other similar documents. The cross-references in the HFE Guide also are clickable and take the user to associated content areas or open new windows on the cross-referenced figures.

Future enhancements to the Guide could take advantage of the cross-referencing ability by allowing users to open multiple windows on information they might wish to compare, view a history of their navigation among content pages and cross-references, save sets of bookmarks associated with different purposes they had in accessing the Guide, store lists of search results under different names and associate histories, bookmarks and search results together.

Those are just a few ideas for how the Guide might be extended, given its current organisation, none of which would be possible working with standalone PDF documents. Given the flexibility obtained from decomposing standards into their constituent parts, many other ideas are sure to emerge as work on the Guide continues.

Of course, a useful additional task would be to enhance the HFE Guide site by offering users access to downloadable PDF versions of the 46855A and other standards; more specifically to ones that contain bookmarks and clickable tables of contents and indexes. Adding those items to PDF documents will require a modest time commitment for each standard but the cost of doing so could be minimised by subcontracting the task to a word processing firm knowledgeable in the creation and editing of PDF documents.

Explore the Implications of Changing Material in HFE-Guide

Whereas the focus of the previous section was on substituting a PDF version of MIL-HDBK-46855A, and possibly other standards, for the current organisational approach taken in the HFE Guide site, this section seeks to understand the advantages to using a search engine technology to help users find the standards information they are seeking.

All of the arguments advanced in the previous section apply to the ideas here. The principal advantage being the flexibility for examining, combining and displaying the many sections of standards to suit the many purposes of users.

Suggesting a search engine technology as a substitute for the current approach, however, raises some interesting possibilities. First, such an approach appears to broaden considerably the domain of relevant content. Instead of restricting a search to well-defined

items on the HFE Guide site, this approach would open the search to standards information residing on any site on the Internet, and possibly some Intranets.

While such an approach undoubtedly would add to the information available to the user, it is more likely to overwhelm him with redundant and irrelevant detail. An all-to-familiar experience in searching for items on the Internet is having a search engine return many thousands of results, only a fraction of which realistically can be examined. Moreover, in navigating even to those limited number of sites, users often must sort through considerable material, much of which is often irrelevant to their needs, in the hope of finding something of interest.

Without an effective way to narrow those search results and to filter the information on potentially relevant sites, such an approach is simply unworkable.

One possible cause for optimism in considering the use of search engines to conduct broader searches for standards information on the Internet is the relatively new, emerging agent technology. Agents are pieces of code that perform highly focused activities, communicate where necessary with other agents in the performance of complex tasks and are relatively persistent in pursuing the task for which they are created, that is, they can function more or less continuously in real time.

Agents potentially can identify a user's needs, search the Internet for information pertinent to those needs, retrieve and filter that information to maximise its relevance and decide if, when and how best to present the filtered information to the user. Of those tasks, the most difficult one is information filtering. Given a database of search results, for example, one or more agents would go to the sites identified, examine the content and attempt to extract portions that are relevant.

If the site contains downloadable documents, the agents may or may not be able to search those documents. If not, it is frequently unclear how effective decisions will be about whether those documents are relevant to the user's needs.

In spite of the difficulties surrounding a search-engine approach to providing standards information to users, the future of such an alternative should be periodically revisited. Agent technology continues to evolve and filtering mechanisms to become more effective. Already, agent technology is being employed in other projects dealing with information retrieval and filtering at DCIEM and that work should prove instructive in a continued monitoring of the technology for its potential usefulness to future HFE Guide work.

No doubt the Internet itself will take on more organised forms that will serve the vast variety of user needs more effectively. As that occurs, the use of search engines and the results they produce likely will become a more attractive alternative. Part of that evolution will include more effective ways of constraining a user's search and better tools for examining the results returned.

As all of that is happening, the focused and flexible approach used for the HFE Guide site will be evolving into a more effective tool for users. In the long term, some combination of the current approach, augmented with results from agent and search engine technologies, may prove to be the best approach to helping users find and use the standards information they require.

Implement the Seven NATO Allied Naval Engineering Publications (ANEPS 20 - 28) Within HFE Guide or Separately

All but two of the ANEP documents, which were in use in other contexts, were reviewed in order to assess the feasibility of adding them to the HFE Guide site. The documents consist of a combination of text, tables and figures with a few formulas scattered throughout.

There is no apparent reason why electronic copies of these documents cannot be created, however in a few cases, because they are copies of originals, some of the figures are of such complexity and so reduced in size that quality suffers. It would be useful, in those cases at least, if originals or copies having the quality of the originals, could be obtained. If not, they could be incorporated as they are or attempts could be made to reproduce them. Unfortunately, this cannot be done in all cases since some are photographs of physical settings and others contain text so small as to be illegible. There also are a handful of figures and tables that may require shading or colouring to bring out the relevant distinctions.

None of the above problems, however, are of such consequence as to prevent the addition of these publications to the Guide. The number of severely degraded items is small and much of the information is discernible.

In almost all cases, the text is clear enough to permit easy typing. The simplest approach to reproducing the figures and tables would be to scan them. This solution would be the easiest and most economical if better quality copies could be obtained.

Assuming that the documents reviewed are the working copies, three types of figures and tables have been identified: 1) those that can be typed or generated using a standard graphics package; 2) those that must be scanned; and, 3) those that contain some portion that must be scanned and require some text to be typed into the figure or table. Taking this approach would greatly enhance the quality of the content of these documents in the Guide.

Table 1 provides a breakdown of the documents with rough estimates of the requirements for handling the different types of figures and tables. The page numbers are approximate as are the figure and table numbers

The shaded cells refer to those ANEPs that were not reviewed. The figures in those cells are estimates based on averages from the other ANEPs. Altogether there are approximately 600 pages of typing, 150 tables and figures that could be typed or generated using a standard graphics package, 45 figures that can be scanned and 90 figures that require the addition of text to the scanned object. All tables and figures require captions to by typed to support search.

Of the figures and tables reviewed, it was determined that about ten are of poor quality, another ten are complex figures that can only be scanned, and approximately six require some colour or shading that may be need to make important distinctions.

Document Categories	Allied NATO Engineering Publication (ANEPs) Number							
	20	21	22	24	25	26	27	28
Text	11			105	65	45	165	45
Tables	6			22	17	5	32	3
Figures	0			5	6	0	4	10
Scanned Figures	0			2	10	2	15	3
Scanned Figures with text added	0			18	0	33	11	0

Table 1. Document Category Requirements for Incorporating ANEPs into the HFE Guide

Make References Selectable, as in the Original HFE-Guide

This requirement would mean that items in the HFE Guide's content window would be clickable and would result in the presentation of referenced material in the same, or a new window.

In principle, there is no reason why this cannot be done. The challenge will be identifying all of the references in the old HyperCard versions (there was never a version that combined the content for all of the HyperCard stacks into one complete application) and specifying those in the Java-based HFE Guide.

The procedure for setting up a clickable reference in the content area of the Guide will require a modest time commitment. What will be time consuming will be identifying all instances, across all stacks, in which a clickable reference occurs and incorporating all instances into the current Guide.

Provide Users the Opportunity to Give Feedback about the HFE Guide Site and Suggest Possible Useful Additions and Modifications

The implementation of facilities for feedback from users of the HFE Guide should be a straightforward exercise. What requires some thought is the design of the interface elements necessary to support such feedback.

One possible approach would be to have a "feedback button" visible in the currently active window. If the user has a suggestion or comment, he can then click the button, which would display a new window in which he could type his comments.. Pausing over the button might bring up a window with comments such as the following:

> *"Improving the HFE Guide is a constant challenge and we value your suggestions in helping us achieve that ongoing goal. No matter where you are in the Guide, you may click on this feedback button and type in your comments. The Guide will store your comments along with an indication of where you are in the Guide when you make them."*

To support the accuracy of the contextual information provided by the Guide, the user could be asked to indicate the part(s) of the Guide to which his comments apply; which might be done by having the user select from a list of areas of the Guide.

Such an option would cover situations in which a user is no longer at the place in the Guide to which his comments apply but has recalled a comment, or thought of a suggestion, when he is at some unrelated section in the Guide.

Finally, the feedback area might request the user's email address so that an automated email messaging system, which could be designed and built into the Guide, could send a "Thank you" message as a follow-up.

Refresh the Portion of the Java Window in the Java Applet Warning Area

A small but persistent problem appears in a portion of the Java Window, used for displaying tables and figures. The problem is a space that appears between the displayed graphic and the section containing the "Forward" and "Back" buttons at the bottom of the window. That space creates a perceived discontinuity in the window's appearance.

ÍÁ" !±w Investigation has revealed that this discontinuity is a function of the Java Applet Warning Area and cannot be removed at present. Developments related to the Java Applet Warning Area should continue to be monitored for changes that might lead to its elimination.

The area makes no functional difference to the user and is small enough to be ignored. For the curious, pausing the cursor over the area could bring up a window describing the problem, which would be an easy feature to implement.

Identify the Source of Each Search Result for the User

A key problem with results of user-initiated searches is that the locations of found information are not identified. It not only may be important for a user to have the information he or she is looking for but also to know in which standard and, more specifically, where in that standard the information is located. This is true for bookmarked items as well.

A proposal to remedy this problem both for search results and bookmarked items would involve a slight re-design of both windows. In each case, an area about the size of a pop-up menu would identify the standard where the search result or bookmarked item was found and a new panel would indicate its location in the hierarchy of the Table of Contents for that standard. Unlike the pop-up menu and table of contents in the main Java Window, the "pop-up" and contents areas in these windows would not be selectable.

Maintain a History of Hypertext Movement When Selecting Cross-References

The problem here is similar in some respects to that described in the previous section but somewhat more complex. Whereas search results and bookmarks are displayed in a separate window, cross-references appear in the main window. When a cross-reference is clicked, it either brings up a figure or table in a separate graphics window or replaces the text in the content area of the main window with the cross-referenced material.

To make matters more complicated, cross-references can have their own cross-references, so that a user may navigate through many levels when pursuing cross-referenced material. Further, some cross-references may refer to items that have already appeared in previous cross-references sections, one or more levels up. Thus, some cross-references are circular, taking the user to sets of cross-references already displayed when previous cross-references were selected.

One solution might be to remove any cross-references that were displayed in previous cross-referenced sections, that is, as the user descends into one set of cross-references after another. That would solve the circularity problem and clean up a lot of redundancy and attendant confusion for the user. While such a solution would not be hard to design and implement, a larger challenge is how to display the source of each cross-reference as it is examined.

After some reflection, one solution that emerged is to update the Table of Contents in the main window to reflect the location of the currently selected cross-reference and, in a similar way to a suggestion in the previous section of this report, make that updated Table of Contents non-selectable. In that way, the user would always know if he were looking at cross-references or were back at the top level of the Table of Contents, that is, at the level at which contents are selectable for navigating to other sections of the Guide.

To make the distinction even more explicit for the user, navigation buttons could appear whenever a cross-referenced item is selected Titles for those buttons might read something like, "Up One Level" and "Top Level," indicating that the user could navigate back up one level in the cross-referenced material or go all the way back to the top level to the selectable Table of Contents.

Identifying the location of selected cross-referenced items and eliminating the circularity in the Guide's current implementation of cross-references would go a long way to making this option a more effective tool for users.

Create "Intelligent Links" Between Task Analysis and Design Guide Material

This task is largely an exercise in compiling, organising and cross referencing material, some of which already exists in the HFE Guide. Information would be combined from several sources:

- the HFE Design Guide for Evaluation Linked to Functions, Tasks and Conditions of Use, referred to on the HFE Guide site as, "Task Info," and which is the task checklist

portion of the Human Factors Engineering Data Guide for Evaluation (HEDGE) (TOP-1-2-610);
- the design checklist portion of the Human Factors Engineering Data Guide for Evaluation (HEDGE) (TOP-1-2-610).
- the Design Criteria for Military Systems, Equipment and Facilities (MIL-STD-1472F);
- Cold Regions Data, for which no documentation currently is available to us;
- Guidance Data (MIL-HDK-759, etc.), for which at least some documentation is available, although more recent versions exist, at least for MIL-HDK-759.

The task is a challenging one for several reasons. First, although a recent discovery yielded a much more legible document for some of the material, other documentation contains text that is quite small, in some cases illegible, and for which better copies may or may not be available.

Second, although the MIL-STD-1472 material is included in the current version of the HFE Guide, there are discrepancies among the versions. The version in the Guide is MIL-STD-1472D, which has now gone through two additional editions, version MIL-STD-1472F being the latest. Any discrepancies will need to be resolved as this work proceeds.

Third, no documentation is available to date on the Cold Regions Data, nor is it clear, given the print quality of the documentation, how extensive those references are. Further, it does not appear that this material is included in the more recent release of the HEDGE document.

Next, from an examination of entries in the recent HEDGE document, it is clear that some references are retained to the Guidance Data, specifically, MIL-HDK-759. This is complicated slightly by the fact that a newer version of this standard is available, namely, MIL-HDK-759A (MI).

At the end of the original HEDGE document, there are many references to other standards. Those appear in a section at the end of the document that contains many figures. The referenced standards are listed on the figures themselves and include the following:

- BUMEDINST 62606
- MIL-A-8806
- MIL-M-18012
- MIL-STD-1333
- MIL-STD-1474
- MIL-STD-250
- MIL-STD-740
- NATICK/TK-77/024
- BUSHIPS-SPEC-1-10
- MIL-C-25050
- MIL-STD-1247
- MIL-STD-1472
- MIL-STD-203
- MIL-STD-411
- MIL-STD-759
- SAE J925

In the more recent HEDGE document, many of those figures do not appear but references to some of the standards are made throughout the documentation. Those references are not as extensive as in the earlier HEDGE.

Lastly, the more recent version of HEDGE, while being more current and legible, does not contain the matrices included in the original version. As such, there are no associated content matrices like there are in the earlier document.

Given the various issues identified above, a key question is whether it is possible to proceed to design and implement something from all these materials that would be of use to

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users of the HFE Guide. The answer to that question undoubtedly is a positive one, as the following comments will make clear.

Given that most references in both versions of HEDGE are to the 1472 standard, likely the best course in approaching what to include would be to use the more recent version of HEDGE with its clear references to the cited items in the 1472 standard.

That version contains references to the 1472D standard and some of those references will have been extended or refined in the new 1472F version. The recommended approach would be to use the HEDGE references to 1472D and, if time permits, check those against the newer 1472F standard. At worst, updating to 1472F could be done at a later time with an appropriate note in the Guide that all current references are to 1472D.

Although the more recent version of HEDGE does not contain the extensive matrices of cross-referenced material found in the original version, it does contain information that would allow similar matrices to be inferred. Inference, along with the models from the earlier version, would allow the creation of new matrices for incorporation into the Guide.

One wrinkle is that a new category, "Functionality," has been added to the categories of "Human Factors Considerations" that appear in the matrices. It appears, however, that this category does not contain new information but simply represents a new way of breaking out the information in the older HEDGE content matrices. It should not be difficult to accommodate this change and the associated content when creating the new matrices.

Re-scan Images at Higher Resolutions (1200 dpi) for Better Print Quality

This is simply a "crank and grind" operation if the images to re-scanned are the ones used in creating the image files that are currently resident on the HFE Guide site. If better quality originals are desirable, then some time may need to be spent locating those images for scanning.

The higher resolution images should be available for display on the HFE Guide site but only where the user wants to print the image. The default images should be the re-sampled images at 72dpi, which is the best quality achievable for screen displays. Double-clicking on a re-sampled image could bring up the higher resolution image for downloading and/or printing by a user.

Implement a Print Function for Items in the Windows of the Java Application

There is extensive support in Java to render pages for printing through the Java printing model and associated API. Using the model and the API, however, is not an easy task and will require time to develop the appropriate mechanisms to provide users of the HFE Guide with an ability to print some or all of the items in the Java Windows.

Replace the Current MIL-STD-1472D Material with MIL-STD-1472F

One issue not included in the original specifications of this contract but which emerged as a special need was the requirement to upgrade the HFE Guide's 1472 standards from 1472D to the new 1472F version.

Both an HTML and a downloadable Word version of the 1472F standard are available. Either one of these documents could be used as the source of the1472F standard for the HFE Guide.

The MS Word version has been downloaded and some preliminary tests have been done to determine how easy it would be to convert into the HFE Guide format It appears that most of the tagging of text can be automated. A sample of several images from the Word file revealed that they were scanned in at 300 dpi, which certainly is adequate for screen display. Although part of the process of extracting and re-sampling those images could be automated, some of this task would have to be done manually.

One advantage over the current material in the Guide is that much of the tabular material in the MS Word document for 1472F is in text form, that is, the contents of the tables are selectable and can be copied and pasted to other documents. Tables in the current HFE Guide are images and the data in those tables are not selectable. It is possible to extract the tables from the MS Word 1472F document and incorporate them as selectable items in an upgrade to that section. Having selectable text in the tables of the Guide undoubtedly would be useful for users of the Guide.

Similar to a suggestion in an earlier section of this report, it would be possible to create a PDF file of the 1472F standard with a clickable Table of Contents and Index. That would produce in a downloadable PDF version which would provide added value to users of the Guide over the HTML and MS Word versions available on other sites.

Cost and Timing Estimates for Enhancements to the HFE-Guide

Work items were identified for the enhancements discussed in the previous section and are included below along with cost estimates, some of which contain optional items. Subcontracting likely will be required in a few cases and a special note "[wp]" indicates where that may be the case. That would include tasks such as typing, graphic production, including design and scanning, and PDF document modifications. That last item was included as a way of providing added value to the HFE Guide site by having downloadable PDF documents of standards with clickable contents and indexes.

I. Replace MIL-HDBK-46855 Material with MIL-HDBK-46855A

- Availability in electronic form?
- Convert text and add delimiters
- Extract figures and tables
- Establish cross-references
- Modify PDF Version – [wp] - *Optional*

Cost Estimates: $9,400; $17,350

II. Implement Seven NATO Allied Naval Engineering Publications (ANEPS20 - 28)

- Availability of Quality Copies
- Type Documents - [wp]
- Construct Tables and Figures - [wp] - *Optional*
- Scan Figures - [wp]
- Add Text to Scanned Figures - [wp] - *Optional*
- Add Formulas - [wp]
- Cross-Reference Figures - [wp]
- Create PDF Versions - [wp] – *Optional*

Cost Estimates: $15,150; $33,250

III. Make References Selectable in HFE Guide

- Determine Clickable Items
- Consider Other Items - *Optional*
- Develop Support Code
- Implement Clickable References

Cost Estimates: $7,600; $8,250

IV. Provide for User Feedback

- Design Feedback Support
- Implement Feedback Support
- Implement Email "Thank You" - *Optional*

Cost Estimates: $5,250; $6,000

V. Refresh Portion of Java Window in Java Applet Warning Area

- Design/Implement Help Message - *Optional*

Cost Estimates: $0.00; $300

VI. Identify Sources of Search Results

- Design for Linking Search Results to Standard & Location
- Implement Design for Search Results and Bookmarks

Cost Estimates: $3,500; $3,500

VII. Maintain History When Selecting Cross-References

- Design History Mechanism
- Tracking to Remove Circularity
- Implement History Mechanism
- Modify Cookies to Accommodate New States

Cost Estimates: $8,250; $8,250

VIII. Create "Intelligent Links" Between Task Analysis and Design Guide Material

- Determine Materials for Inclusion
- Construct Matrices based on HEDGE Documents
- Fill in Content for Matrices, linking to 1472 Standard
- Typing Checklist Material [wp]
- Design Window for Matrix Display
- Implement Matrices with links to 1472 Standard

Cost Estimates: $17,500; $17,500

IX. Re-scan Images at Higher Resolutions (1200 dpi)

- Availability of Quality Copies?
- Re-scanning of c. 300 images [wp]
- Incorporate Images into HFE Guide for Download/Print

Cost Estimates: $6,500; $8,300

X. Implement Print Function for Items in Java Application Window

Design for:

- Extraction of Text from Java Window
- Presentation in HTML form
- Image Presentation
- Selectable Table Presentation

Implement Design for Printing

Cost Estimates: $7,650; $7,650

XI. Replace MIL-STD-1472D with MIL-STD-1472F

- Determine Source File for Standard
- Convert text and add delimiters
- Extract figures and tables
- Establish Cross-References
- Create PDF Version [wp] - *Optional*

Cost Estimates: $16,850; $10,300

A summary table of the above costs appears below. The first column identifies the Item number; the second column contains costs without the optional items; and, the third column contains costs with those optional items included.

Item #	No Options	Options Included
I	$9,400	$17,350
II	$15,150	$33,250
III	$7,600	$8,250
IV	$5,250	$6,000
V	$0	$300
VI	$3,500	$3,500
VII	$8,250	$8,250
VIII	$17,500	$17,500
IX	$6,500	$8,300
X	$7,650	$7,650
XI	$10,300	$16,850
Totals	$91,100	$127,200

Table 2. Summary Cost Estimates for Future Enhancements to HFE Guide

In examining the proposed enhancements, it was clear that they contain a number of uncertainties, which could reduce or increase the time required for completion of these tasks. Among those are:

- the availability of higher quality copies of text, tables and figures;
- the availability of standards in electronic form and whether those are in PDF form or in a more flexible word processing format;
- how easy it will be to identify cross-references in the documents so that at least part of that process can be automated;
- the extent to which the extraction and re-sampling of figures can be automated;
- the extent of clickable references from the old HyperCard versions of the Guide.

At least three approaches are possible to future enhancements the HFE Guide: 1) all items could be included in a next work phase, including all optional items; 2), all work items could be included with some (or none) of the optional items; and, 3) work items could be prioritised and only those thought to be most important included, leaving the remaining work items for the future.

Finally, the time required to complete all of the above work items would be approximately seven months and approximately five months for those work items without the optional items included. Given other commitments, the total calendar time would be nine months and seven months, respectively.

Summary

A number of enhancements were made to DCIEM's Human Factors Engineering (HFE) Guide, which contains a variety of standards information. The Guide currently resides on the following Internet demonstration site:

http://www.interlog.com/~mallin/HFE_IntroPage.html

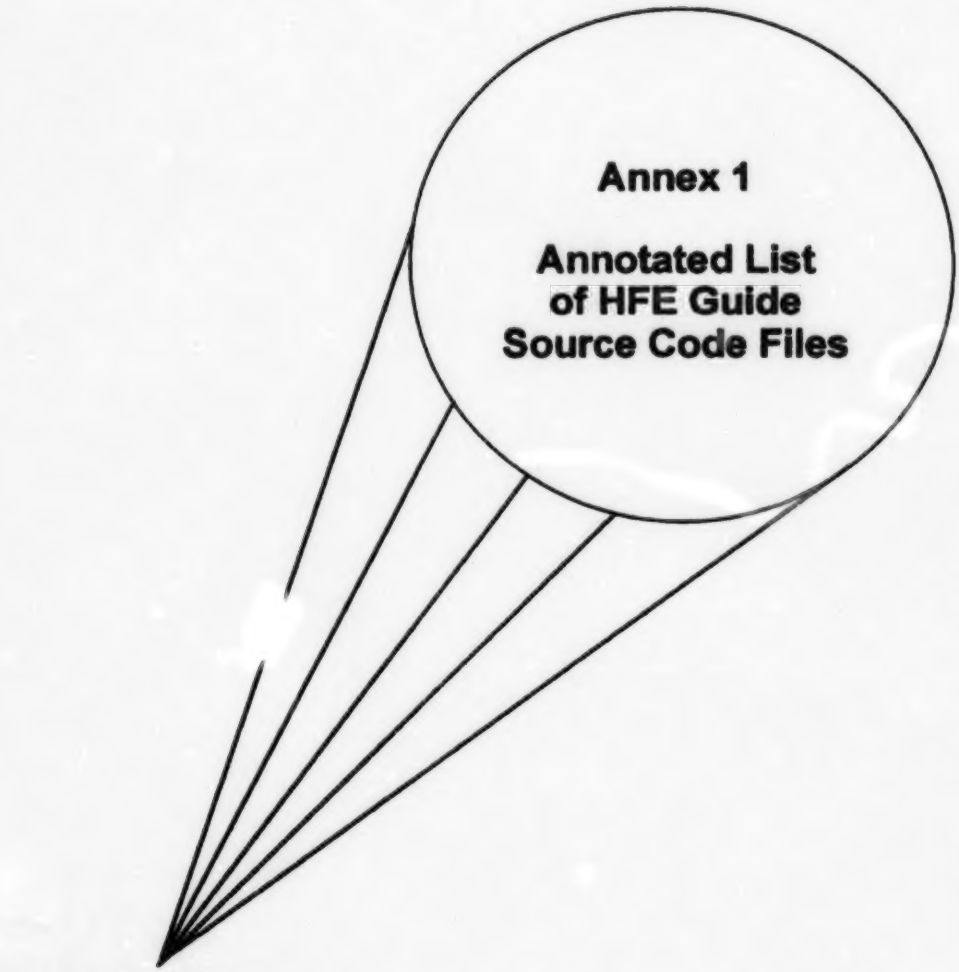
One important addition to the Guide during this work phase was the use of cookies, which now allows for saving the state of the Guide for users when they navigate to other sites on the Internet or log off and return at some later date. The Guide is able to restore the state of a variety of variables including tables of contents for all standards, items in those standards bookmarked by a user and the results from a user's last search.

Additional material was added to the Guide, principally in the form of a Data Item Description (DID) tutorial, and much of the redundancy of the Test Methods and Task Analysis Information sections was removed. Tabs were added to eliminate redundancy in the Test Methods Section and the Java interface was completely re-designed for the Task Analysis Information Section.

Although plans were to upload the Guide to the DRDC DWAN and Public www sites at National Defence, technical issues prevented that task from being completed. Two unresolved issues relate to policies surrounding the use of cookies and to the use of Java on those sites. Discussion will continue with the Scientific Authority and the Manager of the DRDC site in an attempt to resolve those issues in a way that will allow the HFE Guide to be included on one or more of those sites.

All of the application and project files were delivered to Mr. David Beevis, the Scientific Authority at DCIEM, at his request and in lieu of the upload task.

Finally, possible future enhancements to the Guide were explored and detailed descriptions of requirements for eleven new tasks were identified and discussed Despite a number of uncertainties surrounding those tasks, all are achievable in principle. Costs and timing estimates, including costing for a number of optional items within several of those tasks, were provided.



AI→M

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Management and Development Corporation

CGI Source Files

GetSection.c

- This file contains the C code for the CGI that retrieves a specified section of the HFE Guide from the server.

GetUser.c

- This file contains the C code for the CGI that retrieves the user settings from the server.

Search.c

- This file contains the C code for the CGI that searches the HFE Guide text on the server.

SendUser.c

- This file contains the C code for the CGI that stores the user settings on the server.

Java Source Files

HFEGuide.java

- This file contains the Java code for the HFE Guide interface.

HFEGuide.mcp

- This is the Metrowerks CodeWarrior project file for the HFE Guide.

Server files

AirStan.html

- This file contains the HTML code for the Air Standards page

ArrowBullet.gif

- This image is referenced by the "HFEIntro_Page.html" file.

GenStan.html

- This file contains the HTML code for the General Standards page.

GetSection.cgi

- This file contains the executable CGI that retrieves the user settings from the server.

GetUser.cgi

- This file contains the executable CGI that retrieves a specified section of the HFE Guide from the server.

Graphics

- This folder contains all of the image files for the figures and tables.

HFE_Background.gif

- This image is referenced by the "HFE_IntroPage.html" file.

HFE_IntroPage.html

- This file contains the HTML code for HFE Guide Intro page.

HFE Title.gif

- This image is referenced by the "HFEIntro_Page.html" file.

HFEData

- This file contains all of the HFE Guide text.

Java Classes

- This folder contains all of the Java class files for the HFE Guide.

Lookup

- This file contains a look-up table which allows the HFE Guide to find the title of a section given its ID.

Outline1

- This file contains the table of contents information for the "Air Standards - By Topic" section.

Outline2

- This file contains the table of contents information for the "Air Standards - By Series" section.

Outline3

- This file contains the table of contents information for the "MIL-STD-1472 Section 5" section.

Outline4

- This file contains the table of contents information for the "MIL-STD-1472 Except Section 5" section.

Outline5

- This file contains the table of contents information for the "MIL-STD-1472 Figures and Tables" section.

Outline6

- This file contains the table of contents information for the "MIL-STD-46855" section.

Outline7

- This file contains the table of contents information for the "Data Item Descriptions (DIDs)" section.

Outline8

- This file contains the table of contents information for "Task Analysis Info" section.

Outline9

- This file contains the table of contents information for the "Test Methods" section.

Outline10

- This file contains the table of contents information for the "DID Tutorial" section.

OutlineHelp

- This file contains the table of contents information for the "Help" section.

OutlineGlossary

- This file contains the table of contents information for the "Glossary" section.

RD_DCIEM.gif

- This image is referenced by the "HFE_IntroPage.html" file.

Search.cgi

- This file contains the executable CGI that searches the HFE Guide text on the server.

SendUser.cgi

- This file contains the executable CGI that stores the user settings on the server.

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12. DOCUMENT RELEASABILITY

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14. ABSTRACT

(U) Extensions and refinements were made to DCIEM's Human Factors Engineering (HFE) Guide, containing a variety of standards information currently accessible to users on an Internet demonstration site supplied by AIM. A key addition to the Guide was the use of cookies, which now allows the Guide to restore the state of a variety of variables when that user returns from other sections or after logging off and returning at a later time. The restored state includes items in the standards that were bookmarked by the user and the results of the user's last search. Additional material was added to the Guide and redundancy removed from two sections of its sections. For one of those, a re-design of the Java interface was required. Although plans were to upload the Guide to the DRDC DWAN and Public www sites, technical issues prevented that task from being completed in this work phase. Two unresolved issues relate to policies surrounding the use of cookies and to the use of Java on the DRDC sites. Discussion will continue with the Scientific Authority and the Manager of the DRDC site in an attempt to resolve those issues in a way that will allow the HFE Guide to be included on one or more sites. Finally, some future enhancements to the Guide were examined and requirements for eleven new tasks discussed. A number of uncertainties surround those tasks but, in principle, all can be achieved. Costs and timing estimates were provided.

15. KEYWORDS, DESCRIPTORS or IDENTIFIERS

(U) human factors guidance
human factors engineering